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PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN OR RELATING TO RESUSCITATION APPARATUS

(71) We, PAUL HEX VENN, a British Subject, formerly of 36, Ratton Drive, Eastbourne, Sussex, and now of 5, The Close, Huggetts Lane, Willingdon, Eastbourne, Sussex, and ARTHUR MARTIN, a British Subject, formerly of 1, Hammerwood Road, Ashurst Wood, East Grinstead, Sussex, and now of Tandlisdale Engineers Limited, rear of Harrison Gooding House, Forest Row, Sussex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to resuscitation apparatus of the kind having a resilient bag which can be squeezed to force air through a valve into the patient's lungs using a face mask which is put over the patient's face. The valve has to permit the air to pass into the lungs from the bag but must prevent exhaled air passing into the bag. Such a valve is known as a non-rebreathing valve and one of the objects of the present invention is to provide improved constructions of such a non-rebreathing valve.

According to the present invention, a resuscitation apparatus comprises a non-rebreathing valve connected between a face mask and a squeezable resilient bag, said bag being for forcing air through the non-rebreathing valve into the face mask, wherein the non-rebreathing valve comprises a non-return valve mounted in a carrier slidable within a tube which tube connects the bag to the face mask, the non-return valve in use permitting air flow from the bag to the mask but not from the mask to the bag and the carrier being movable by the difference of air pressure in the bag and the mask, when the bag is squeezed, from a first position in which air can enter the bag from ambient atmosphere through inlet ports in the tube and exhaled air can pass from the mask through outlet ports in the tube to a second position where the inlet and outlet ports are closed by the carrier, the carrier being located so that the non-return valve is between the inlet and outlet ports when the carrier is in said first position.

With this form of construction, when the bag is squeezed, the valve carrier moves so as to close the inlet and outlet ports and the air in the bag is forced through the valve into the face mask. As soon as pressure on the bag is relaxed, the non-return valve closes and as soon as the patient exhales the valve carrier is moved back so as to open the ports for exhaled air and also to open the ports for air to enter the bag.

The valve carrier need not, and preferably is not, biased in any direction so that it is responsive solely to difference in pressure between the air in the bag and in the face mask. Squeezing of the bag forces the carrier to said second position. The non-return valve will close as soon as squeezing of the bag ceases. If the patient exhales and/or if the pressure on the bag is relaxed, the carrier will return to the first position.

Conveniently the valve carrier comprises a tube with at least one set of ports in its cylindrical surface, which ports are aligned with said inlet ports when said carrier is in said first position. The outlet ports, which lie beyond the outer end of the carrier when the latter is in said first position, are blocked by the carrier when it moves to said second position.

The spring-loaded valve may be a flap valve but preferably is a spring-loaded valve urged by the spring into the closed position. By this construction it is possible to make the whole non-rebreathing valve assembly of metal so that it can be sterilised using conventional hot water or steam sterilising equipment.

As is described and claimed in the specification of Application No. 15620/69 (Serial No. 1,238,650), a non-return valve may be provided through which oxygen can be drawn into the bag whereby oxygen-enriched air may be administered to the patient.

The following is a description of a num-

ber of embodiments of the invention, reference being made to the accompanying drawings, in which:—

Figure 1 is a longitudinal section through one construction of part of a resuscitation apparatus showing a non-rebreathing valve;

Figure 2 is a diagram of the non-rebreathing valve of Figure 1 showing the valve in the position where air is being forced from the bag into a face mask; and

Figures 3 and 4 are diagrams illustrating further constructions of non-rebreating valves.

Referring to Figures 1 and 2, the resuscitation apparatus comprises a bag 10 of flexible impermeable material having an inner lining 11 of resilient foamed rubber or elastomeric plastics material such that the bag is self-inflating to take a generally ellipsoidal form. In the particular construction illustrated, at one end of the major axis of the ellipsoid formed by the bag, the outer lining 10 is sealed to a metal tube 12 which contains a non-return valve 13 and which forms an oxygen inlet if the apparatus is to be used for administering oxygen-enriched air to a patient. The use of such a non-return valve for an oxygen inlet in resuscitation apparatus is more fully described and claimed in the specification of co-pending Application No. 15620/69 (Serial No. 1,238,650) and reference may be made to that specification for a further description of this part of the apparatus. If oxygen-enriched air is not to be used or if an oxygen supply is not available, the resuscitation apparatus can be used for administering air to a patient since when the bag is squeezed, the non-return valve 13 is closed. In the present specification no further reference will be made to this possibility of using oxygen-enriched air.

The present invention is concerned more particularly with the non-rebreathing valve 20 which is arranged between the outlet passage from the bag 10 and a face mask (not shown). The bag 10 is sealed onto an air outlet tube 21 formed of plastics material. This tube is slightly resilient and the non-rebreathing valve 20 is a press fit on the end of the tube 21. This non-rebreathing valve comprises a metal tube 22 which fits over the end of the tube 21, the tubes overlapping to an extent determined by a stop formed by a screw 23. Within the tube 22 is a valve carrier 24 which is of tubular form and has on its cylindrical surface a set of ports 25. The carrier 24, when at the inner limit of its travel as show in Figure 1, has the ports 25 aligned with a set of ports 26 in the outer tube 22 so that air can pass freely through the ports 26 and 25 into the interior of the bag 10. In this position, the carrier 24 does not obstruct a further set of ports 27 in the tube 22 so that these ports communicate freely with the outlet port 28 of this tube 22 leading to the face mask. This position of the carrier 24 is the position assumed when the patient is exhaling and when the pressure on the bag 10 is released. Exhaled air passes freely through the ports 27 whilst air can be drawn into the bag through the ports 26 and 25. Extending across the tube forming the carrier 24 is a spring-loaded valve 30 comprising a disc portion 31 on a stem 32 and a spring 33 which urges the disc portion 31 against a seat formed by an inwardly directed flange 34. This seat is located beyond the ports 25 in the direction outwardly from the bag and always lies between the ports 26 and 27. The valve 30 forms a non-return valve permitting flow outwardly from the bag but preventing exhaled air passing into the bag. When the bag is squeezed, the valve 30 opens so that air can pass from the bag into the face mask. The higher air pressure in the bag causes the carrier 24 to move outwardly to a stop formed by an internally directed shoulder 35 on the tube 22; the carrier 24 then blocks the ports 26 and 27. In this condition the air from the bag passes freely through the valve 30 and into the face mask. As soon as pressure ceases to be exerted on the bag, the valve 30 will close due to the action of spring 33. When the patient exhales and/or when the bag is allowed to expand, the pressure difference will cause the carrier 24 to move back to the inner stop formed by the aforementioned screw 23 so opening ports 27 to allow the exhaled air to exhaust and aligning the ports 25 with the ports 26 so that air can enter the bag. The natural resilience of the bag will cause the carrier 24 to return to this position as soon as the bag is allowed to expand. Thus, even in the absence of the patient exhaling, the bag will fill with air drawn through the ports 25, 26.

Figure 3 illustrates another construction of non-rebreathing valve which is generally similar to that of Figures 1 and 2 and corresponding reference numerals have been used for the corresponding components. In the construction of Figure 3 however, in place of the spring-loaded valve 30 there is provided a flap valve 38.

Another construction of valve is illustrated in Figure 4. The resuscitation bag is attached to one end of a tubular member 40, part of this bag being shown at 41. The tubular member is partially closed at the other end by a wall 42 having outlet ports 43 for exhaled air, this wall having a central opening 44 leading to a conical tubular portion 45 to which a pipe (not shown) leading to the face mask (not shown) is attached. Inlet ports 46 for air to enter the resuscitation bag are formed in the outer wall of the tube 40. These ports lead into an annular region 47 bounded by an inner cylindrical wall 48 hav-

ing end walls 49, 50. The end wall 50 has ports 51 which are for the purpose of permitting airflow from the ports 46 through the region 47 into the resuscitation bag 41. The ports 51 can be closed by a sealing flange 52 on a valve carrier 53 which slides within the cylindrical wall 48. This valve carrier 53 has a further flange 54 which limits the travel of the carrier 53 by bearing at the inner extremity of its travel against the outer surface of the wall 49 and bearing at the outer extremity of its travel against the inner surface of the wall 42 to close the ports 43. The passage through the valve carrier 53 is closed by a flap valve 55 which is arranged to open when the pressure in the bag exceeds the pressure in the outlet region 44.

It will be seen that the valves of Figures 3 and 4 operate in a manner closely analogous to that of Figures 1 and 2 to permit air to be forced from the bag into the face mask but preventing exhaled air being drawn into the bag.

WHAT WE CLAIM IS:—

1. Resuscitation apparatus comprising a non-rebreathing valve connected between a face mask and a squeezable resilient bag, said bag being for forcing air through the non-rebreathing valve into the face mask, wherein the non-rebreathing valve comprises a non-return valve mounted in a carrier in a tube and the carrier being slidable within the tube, which tube connects the bag to the face mask, the non-return valve in use permitting air flow from the bag to the mask but not from the mask to the bag and the carrier being movable by the difference of air pressure in the bag and the mask, when the bag is squeezed, from a first position in which air can enter the bag from ambient atmosphere through inlet ports in the tube and exhaled air can pass from the mask through outlet ports in the tube to a second position where the inlet and outlet ports are closed, by the carrier, the carrier being located so that the non-return valve is between the inlet and outlet ports when the carrier is in said first position.

2. Resuscitation apparatus as claimed in claim 1 wherein the carrier comprises a cylindrical tube with at least one set of ports in its cylindrical surface, which ports are aligned with said inlet ports when the carrier is in said first position.

3. Resuscitation apparatus as claimed in either claim 1 or claim 2 wherein said non-return valve is a flap valve.

4. Resuscitation apparatus as claimed in either claim 1 or claim 2 wherein said non-return valve is a spring-loaded valve urged by the spring into a closed position.

5. Resuscitation apparatus as claimed in claim 4 wherein the non-rebreathing valve is wholly made of metal.

6. Resuscitation apparatus as claimed in any of the preceding claims wherein the inlet and outlet ports each comprise a set of ports disposed circumferentially around the tube connecting the bag to the face mask.

7. Resuscitation apparatus having a non-rebreathing valve and substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

8. Resuscitation apparatus having a non-rebreathing valve and substantially as hereinbefore described, with reference to Figure 3 or Figure 4 of the accompanying drawings

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Sheet 1

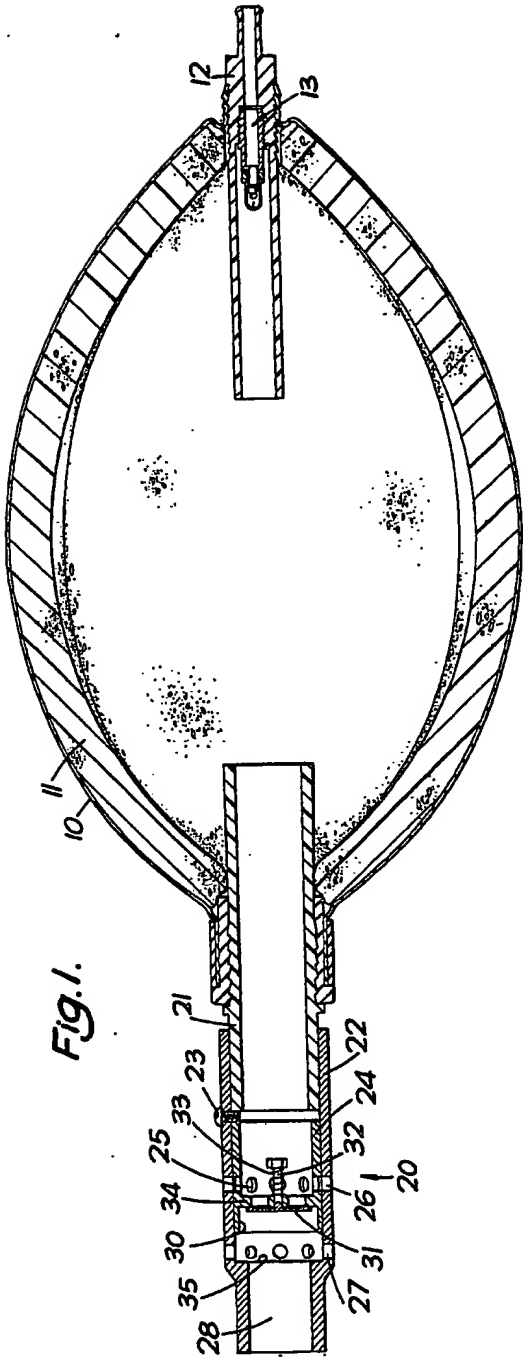

Fig. 1.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

Fig. 2.

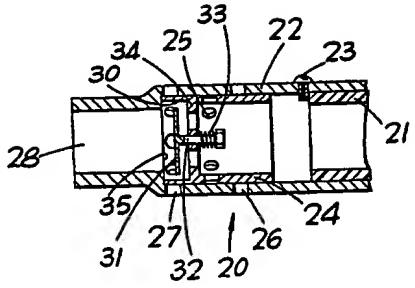

Fig. 3.

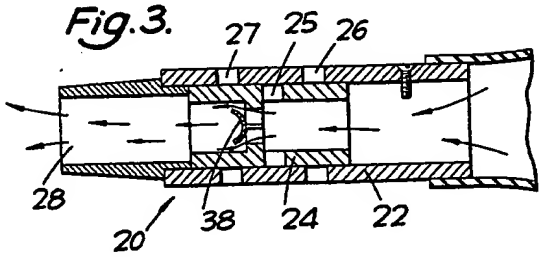

Fig. 4.